MATH 5335-18532
TECHNIQUES in OPTIMIZATION
The University of Texas at El Paso

Instructor: Dr. Miguel Argaez, margaez@utep.edu
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Term: Fall Semester 2021

Credit Hours: 3

Meetings & location: TH 1:30 p.m. – 2:50 p.m.  Class Room Building C304

Office Hours: TH 3:00 p.m. - 4:00 p.m. and by Appointment

Prerequisites: Linear Algebra or Numerical Analysis, Basic Knowledge of Matlab Programming.


Motivation and Description:
Everyday grows the need to formulate applications that arise in science, engineering, and business as either an unconstrained or a constrained optimization problem. This class covers the fundamental theories in continuous optimization and MATLAB implementation software. We study the solution of square nonlinear equations and minimization of an objective function. Also, we study the solution of linear and nonlinear least-squares problems.

Course Schedule:

1. Distance Notion (Norms)
   1.1 Definition of absolute value and interpretation
   1.2 Analysis of the absolute value function
   1.3 Definition of distance in 1-variable and properties
   1.4 Extension of distance notion to several variables
   1.5 Distance using 1-norm
   1.6 Distance using infinity-norm
2. Newton’s Methods for Unconstrained Problems
   2.1 Solving one nonlinear equation in one variable
   2.2 Solving minimization of a function in one variable
   2.3 Globalization Strategies: line search and steepest-descent

3. Newton’s Method for Unconstrained in Several variables
   3.1 Solving square nonlinear equations
   3.2 Solving minimization of a function in several variables
   3.3 Globalization Strategies: line search and steepest-descent

4. Linear Least-Squares Problems (LSP)
   4.1 Problem formulation
   4.2 Solving Linear least-squares problems
   4.3 Tikhonov regularization
   4.4 L-1 norm regularized least-squares
   4.5 Stopping criteria

5. If time permits: Nonlinear Least-Squares Problems (NLSP)
   5.1 Problem formulation
   5.2 Newton method for NLSP
   5.3 Gauss-Newton method for NLSP
   5.4 Levenberg-Marquardt method for NLSP
   5.5 Stopping criteria

Grading Policy: Homework: 20%. Two Midterm Exams 25% each. Final Exam 30%

Make-up Policy: No make-up/alternate exam will be given.

Attendance Policy: It is student’s responsibility to attend every class. Students are expected to arrive for class on time and to remain for the class entire period.

Academic Calendar:
- Sept 6: Labor Day Holiday – University Closed
- Oct 29: Fall Drop/Withdrawal Deadline
- Nov 25-26: Thanksgiving Holliday - University Closed
- Dec 2: Last Day of Classes
- Dec 9: Final Exam from 1:00 pm - 3:45 pm

Academic Integrity Policy:
The University policy is that all suspected cases or acts of alleged scholastic dishonesty must be referred to the Dean of Students for investigation and appropriate disposition. Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but is not limited to cheating, plagiarism, collusion, and the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts. For further information, please refer to:

http://www.lib.iastate.edu/commons/resources/facultyguides/plagiarism/dishonest.html
Civility Statement:
Please do not use cell phones, pagers, iPods, MP3 players, blue tooth devices, etc. during class. Cell phones and pagers should be set to silent or vibrate, and any calls should be taken outside of class. Please do not wear headsets or blue tooth devices during class.

Disability Statement:
If a student has or suspects she/he has a disability and needs an accommodation, he/she should contact the Disabled Student Services Office (DSSO) at 747-5148 or at <dss@utep.edu> or go to Room 106 Union East Building. The student is responsible for presenting to the instructor any DSS accommodation letters and instructions.

Military Statement: If you are a military student with the potential of being called to military service and/or training during the semester, please contact me by the end of the first week of class.